ABSTRACT

The objective of this research work is to define the requirements needed to transform the City of Hernandarias and the Itaipu Tourist Complex, on the Paraguayan side, as intelligent tourist destinations (ITD). It was based on a quantitative, non-experimental, cross-sectional approach with an exploratory scope. The unit of analysis was the urban center of Hernandarias and the Tourist Complex, in order to gather information on their potential and the fulfillment of the action proposals required in an ITD. The instrument used was a checklist of 15 attributes with a total of 44 criteria, distributed in 6 proposals for action (PA), yielding the following main results: 92% compliance with PA2 (Technological developments applied to Mobility and Urban Planning) in the complex and 78% in the city. Likewise, compliance with PA5 (Technological developments applied to Public Safety) was 0% in the complex and 11% in PA6 (Technological developments applied to Health) in the city. It is concluded that by complying with 100% of the PAs, joint government-binational-private sector actions should be generated for this destination to be fully considered as an ITD.

Keywords: smart cities; smart tourism destination; tourism potentialities; city of Hernandarias; Itaipu Tourism Complex; binational

1. Introduction

Cities are places of concentration of economic activity, creativity and human talent[1], catalyze economic development and serve as the basis as incubators of new ideas and innovations[2]. Although they represent only 3% of the earth, they consume between 60 to 80% of energy and produce about 70% of carbon emissions[3].

In 2019, the tourism industry accounted for 10% of the global economy and generated one in ten jobs worldwide[4]. Tourism has very positive effects for destinations, such as economic development and employment generation[5]. Currently, the worrying situation of natural resources, climate change and biodiversity loss are affecting this sector. Thus, a new common line of work for all economic sectors emerges, sustainable development, as a model of participation, both in public agencies and private companies, local citizens and tourists, which aims to counteract the current situation caused mainly by the mismanagement of environmental resources.

Tourism is called to play a fundamental role in
the socio-economic and environmental recovery of
countries, given its multiplying effect, capable of
generating an impact on all sectors of society and its
reactivation\[6\]. It is important to emphasize that the
institutions in charge of facilitating this role of reac-
tivating and developing tourism in a locality
should be attentive and cooperative, since teamwork
shows more potential. However, sustainable tourism
implies respecting socio-cultural and environmental
aspects, seeking the conservation of resources of
both natural and cultural character-tangible and
intangible-valuing and maintaining them to be en-
joyed in the future\[7\]. This process, should allow the
appropriate use of resources and their valorization,
with which it is possible to contribute to the under-
standing and awareness of tolerance among diverse
cultures.

The world tourism organization\[8\] defines sus-
tainable tourism as that which:

It serves the needs of current tourists and host
regions while protecting and promoting opportuni-
ties for the future. It is conceived as a path towards
managing all resources in such a way that economic,
social and aesthetic needs can be met while respect-
ing cultural integrity, essential ecological pro-
cesses, biological diversity and life-support systems.

And the authors, Bouskela et al.\[9\], refer to a
smart city as one that:

Places people at the center of development, in-
corporates information and communication technol-
gies in urban management, and uses these elements
as tools to stimulate the formation of an efficient
government that includes collaborative planning pro-
cesses and citizen participation. By promoting inte-
grated and sustainable development, smart cities be-
come more innovative, competitive, attractive and
resilient, thus improving lives. This type of cities—
The smart cities represent an important element for
the tourism sector, which added to a correct planning
are possible to become tourist attractions or tourist
centers. Likewise, the so-called energy cities are
other cities that could be vacation cities for tourism.

The term energy cities arise in Switzerland al-
ready more than 25 years ago and has been success-
fully adapted in several countries in Europe, Africa
and Latin America, as a management tool for munic-
ipalities with the aim of implementing energy effi-
ciency, renewable energy and sustainable mobility
projects on a local scale\[10\]. These cities in which re-
newable energies are used aiming at sustainable
development and when combined with the concepts of
smart cities and tourism, it is feasible to talk about
smart tourism destinations (itd). The concept of
smart destinations derives from the application of the
smart cities management model to tourism. Smart
cities and destinations share a city and territory de-
sign in which technology is an intrinsic part of the
model: in data collection, in information manage-
ment and in the implementation of measures that
seek a more efficient use of resources and a higher
quality of life for the people who inhabit and travel
in those spaces\[11\]. The main objectives of DITs are
the generation of more accurate, continuous and up-
dated information on key aspects in the management
of cities and destinations: energy consumption,
waste control, mobility of people, climate, among
others\[12\], considering these aspects, it is feasible to
think of creating this type of destinations for the ex-
pansion of tourism in Paraguay, so it is proposed as
the main objective to define the requirements nec-
essary to transform the city of Hernandarias, as a smart
tourist destination in conjunction with the tourist
complex of the Itaipu hydroelectric power plant, Par-
aguayan side.

2. Methodology

The study has a quantitative approach, non-ex-
perimental cross-sectional design with exploratory
scope, carried out in the city of Hernandarias, in June
2021. the study area corresponded to the urban area
of the city of Hernandarias and the Itaipu binational
tourist complex on the Paraguayan side. The inclu-
sion criteria were: innovative space consoli-
dated based on the territory, commitment to environ-
mental, cultural and socioeconomic factors, visitor
interaction with the environment and quality of the
tourist experience. The places chosen for the present analysis contain some of the characteristics of a smart tourism destination, as defined by the tourism intelligence system\(^1\). The instrument consisted of a checklist classified into six proposals for action, 15 attributes and 44 criteria. See Table 1.

Table 1. Structure of the check list with the proposals for action, attributes and criteria

<table>
<thead>
<tr>
<th>Proposals for action—PA (6)</th>
<th>Attributes (15)</th>
<th>Criteria (44)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Access to devices with updated digital information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Personalized advice on the use of apps linked to the destination</td>
<td></td>
</tr>
<tr>
<td>PA1 Technological developments applied to tourism. (4)</td>
<td>Georeferenced tourism products, services and resources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real-time data collection</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Digital information sources</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Georeferenced destination guides</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitoring of visitor behavior</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real-time information</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Augmented reality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geolocation systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Video-mapping techniques</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Holographies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Business intelligence systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Competitive intelligence systems</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training, collaboration and knowledge generation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Knowledge generation</td>
<td></td>
</tr>
<tr>
<td>PA2 Technological developments applied to increase the company’s competitiveness. (3)</td>
<td>Visitor relationship management systems (crm)</td>
<td></td>
</tr>
<tr>
<td>Management systems (3)</td>
<td>Reservation management systems (crs)</td>
<td></td>
</tr>
<tr>
<td>Marketing systems (2)</td>
<td>Content management systems, integration with social networks and positioning.</td>
<td></td>
</tr>
<tr>
<td>Internet access (2)</td>
<td>B2b marketing systems</td>
<td></td>
</tr>
<tr>
<td>PA3 Technological developments applied to mobility and urban planning. (2)</td>
<td>B2c marketing systems</td>
<td></td>
</tr>
<tr>
<td>Management of the transportation and visitor system (6)</td>
<td>Efficient intermodal transport management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real-time traffic management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Updated information on optimal routes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Public transportation information: location, occupancy, frequency, price, etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mobile applications for parking management</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real-time visitor flow management in the territory</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Renewable energy generation</td>
<td></td>
</tr>
<tr>
<td>PA4 Technological developments applied to energy and sustainable development. (2)</td>
<td>Use of led technology, with photocells and motion sensors</td>
<td></td>
</tr>
<tr>
<td>Renewable energies and environmentally friendly technologies (3)</td>
<td>Irrigation based on soil conditions</td>
<td></td>
</tr>
<tr>
<td>Measurement of environmental parameters (2)</td>
<td>Efficiency in the treatment of solid waste</td>
<td></td>
</tr>
<tr>
<td>PA5 Technological developments applied to public safety. (1)</td>
<td>Monitoring of water quality, air pollution, noise pollution, etc.</td>
<td></td>
</tr>
<tr>
<td>Apps management (3)</td>
<td>Multilingual mobile application for complaints</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Video monitoring in insecure areas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>location sensors in large events and shows and presence control</td>
<td></td>
</tr>
<tr>
<td>PA6 Technological developments applied to healthcare. (3)</td>
<td>Multilingual applications for access to medical records and treatments</td>
<td></td>
</tr>
<tr>
<td>Apps management (1)</td>
<td>Information on solar UV radiation</td>
<td></td>
</tr>
<tr>
<td>Preventive healthcare (4)</td>
<td>Geolocation of pharmacies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real-time traffic management systems</td>
<td></td>
</tr>
</tbody>
</table>
The steps for data collection were: Once the instrument or check list adapted from Segittur\textsuperscript{12,13} was adapted to the research study, a visit was made to the urban center of the city of hernandarias and to the itaipú binacional tourist complex on the Paraguayan side to fill out the instrument through observation, marking whether or not the criteria evaluated in this research were met. Likewise, the websites of the tourist complex and the municipality, some tourist service providers and the tourist information center of the city were consulted to corroborate the fulfillment of some of the criteria.

### 3. Results

The data obtained in the study carried out and considering the main requirements, such as: Proposals for action, attributes and criteria to be taken into account for a city to become an itd, show that the city of hernandarias and the itaipú binacional tourist complex, on the Paraguayan side—The latter already consolidated as a tourist destination for Paraguay—Meet several of these aspects and criteria that fit within the characteristics of itds, as shown in Table 2. According to the criteria compliance of the Itaipu binational tourism complex, the results show that the action proposal (ap) with the highest percentage of compliance is ap3: Technological developments applied to mobility and urbanism (92%) and the one with the lowest compliance is ap6: Technological developments applied to sanitation (17%). Likewise, none of the criteria of pa5 are met: Technological developments applied to public safety (0%). See Table 2.

<table>
<thead>
<tr>
<th>Action proposals</th>
<th>Attributes</th>
<th>Criteria</th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA1</td>
<td>Access to devices with updated digital information</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Personalized advice on the use of apps related to the destination.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Georeferenced tourism products, services and resources.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real-time data collection</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Big data/open data</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Monitoring of visitor behavior</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Digital information sources</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Georeferenced destination guides</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mobile App applications</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real-time information</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Augmented reality</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geolocation systems</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Video-mapping techniques</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Holography</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Intelligence systems</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Business intelligence systems</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Competitive intelligence system</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Training, collaboration and knowledge generation systems</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visitor relationship management (CRM) systems</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reservation management systems (CRS)</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Content management systems, integration with social networks and</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marketing systems</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>B2b marketing systems</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
If only the urban center of the city of hernandarias is considered, the results show a low level of compliance with several of the action proposals, such as: In PA6: Technological developments applied to health (11%) and 33% for PA1: Technological developments applied to tourism, PA3: Technological developments applied to mobility and urban planning and PA5: Technological developments applied to public safety. However, those with the highest compliance is PA2: technological developments applied to increase the competitiveness of the company (78%). See Table 3.

Table 3. Compliance with the criteria for the urban center of the city of hernandarias

<table>
<thead>
<tr>
<th>Proposed action</th>
<th>Attribute</th>
<th>Criteria</th>
<th>Complies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tourist informa-</td>
<td>Access to</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>tion offices (67%)</td>
<td>devices with updated digital information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PA1 Technologi-</td>
<td>Personalized advice oriented to the use of apps linked to the destination</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>cal develop-</td>
<td>Georeferenced tourism products, services and resources.</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>ments applied to</td>
<td>Real-time data collection</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>tourism (33%)</td>
<td>Visitor behavior monitoring</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Digital information sources</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Georeferenced destination guides</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Real-time information</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Augmented reality</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Geolocation systems</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>
The city of Hernandarias and the Itaipu Binacional Tourist Complex as smart tourist destinations

Other technological elements applied to the tourism sector (33%)
- Video-mapping techniques
- No
- Holography
- No
- Business intelligence systems
- No
- Competitive intelligence system
- No
- Training, collaboration and knowledge generation systems
- Yes

Intelligence systems (33%)
- Visitor Relationship Management (VRM) Systems
- Yes
- Reservation management systems (RMS)
- Yes
- Content management systems, integration with social networks and positioning
- Yes
- B2B marketing systems
- Yes
- B2C marketing systems
- Yes
- Wi-Fi network with free access in the territory
- Yes
- WiMAX network for data transmission
- No
- Efficient management of intermodal transportation
- No
- Real-time traffic management
- No
- Up-to-date information on optimal routes
- No
- Public transportation information: Location, occupancy, frequency, price, etc.
- Yes
- Mobile applications for parking management
- No
- Management of visitor flow in the territory in real time
- No
- Renewable energy generation
- No
- Use of LED technology, with photocells and motion sensors
- Yes
- Irrigation based on soil conditions
- No
- Efficiency in the treatment of solid waste monitoring of water quality, water pollution
- Yes
- Air pollution, noise pollution, etc.
- Yes
- Multilingual mobile application for complaints
- No
- Video monitoring in unsafe areas
- Yes
- Location sensors in large events and shows and presence control
- No
- Multilingual applications for access to medical records and treatments
- No
- Information on solar UV radiation
- No
- Geolocation of pharmacies
- Yes
- Real-time traffic management systems
- No
- Updated information on optimal routes
- No
- Generics
- No
- Recommended doses
- No

Source: Own elaboration

4. Discussion

Smart tourism destinations or itd are key to development and tourism competitiveness[14], they require investment primarily in education, ICT, infrastructure and human talent that is committed to developing the community in a sustainable manner. In addition, it generates income in the long term, but above all to the development of tourism if the proposals for action that guarantee its sustainability are efficiently applied, it is characterized by an intensive use of technology and an intelligent management of...
The data produced[10].

The Itaipu binacional complex largely complies with the proposals for action, obtaining in four of six of them compliance over 70%, however, it is observed that aspects referring to technological development applied to public safety (0%) and technological development applied to health (17% compliance only) are not yet considered, both actions that are an important part for an ITD to generate a safe image for the visitor, in the case of the urban center of the city, more actions are still needed to achieve a higher level of compliance, only two of the six proposals for action exceed 50%, showing a lack of investment in developing technologies applied to tourism (33%), as well as technologies applied to mobility and urban planning (33%), public safety (33%) and health (17%), as it is considered that the municipal government still does not see the great potential that tourism has for its locality, does not invest in technological development and does not develop innovations. Likewise, they still do not consider the use of information and communication technologies (ICT) as feasible tools to generate a sustainable destination.

Even so, it can be considered that there is potential in the city of Hernandarias for the same, aiming to become an ITD hand in hand with the Itaipu tourist complex, but it requires greater investment, interest and predisposition to achieve it, as it will be necessary that proposals for action linked to technological development applied to tourism, which in the urban center only represents 33% compliance, especially those related to big data and open data (33%) and application development (0%) such as: Augmented reality, video mapping techniques and Holographies where different tourist resources of the city can be appreciated.

Likewise, the development of apps (mobile applications) to manage parking lots, make complaints, video monitoring and location, with an overall compliance of 33%, will be very useful. As well as those for health and geolocation of health care centers and pharmacies, since these are the attributes with the lowest level of compliance, only 11% overall. The low level of compliance with these attributes is because they are not considered to improve decision making, operational efficiency, the provision of urban services and their competitiveness. It is also of utmost importance to understand that, in order to achieve the sustainability of the destination, it is necessary to have technology that allows the appropriate use of natural resources, with renewable energies, environmentally friendly technologies and efficiency of water use, waste treatment and monitoring of pollution caused by various activities, particularly tourism.

Considering the application of these proposals for action in other cities, as mentioned by[15] in the case of the smart tourist destinations project of the Valencian community (ITD-cv), Spain, it is necessary, to define a strategy and proposal of actions for the configuration of ITDs, to propose technologies and methods for the development of the project results and to count on the participation of tourism agents in the analysis and in the proposals that emanate from the project results.

For the latter, it is of vital importance that both the city of Hernandarias, its governors, tourism stakeholders and community in general, together with the Itaipú Binacional Tourism Complex, Paraguayan side, converge through constant and coordinated work to fully develop it as an ITD, supported by senator and in collaboration with the education institutes to develop this destination in a planned manner, where the main pillars are the generation of knowledge and innovation, as referred by Huang et al.[16], thus achieving to have a more affable look from the great defenders of the environment and innovation for the avant-garde of technology.

But it will be necessary to work more with those attributes with low level of compliance especially in the urban center of the city, where it is more lacking in technological development encouraging the generation of projects that aim to remedy the lack of tourist advice through the use of apps, generation of the “big data/open data” for the tourism sector, effi-
cient management of transport systems for the community and visitors, as well as investing in programs for the generation of security and sanitation systems of the city.

To emphasize that the possibility of betting for an ITD, will bring progress to the city and would be a precedent of great importance for other destinations of the country with similar characteristics. The joint and constant work between the municipality and the Itaipu binational tourist complex, Paraguayan side, is urged to unify as a tourist destination and with the investment of both parties, transform the city into an intelligent tourist destination, thus demonstrating the efficient use of energy and technology as fundamental pillars of sustainable development of the community.

Confict of interest

The authors declare no conflict of interest.

References

1. Adler V. 8 temas que deben cuidar las ciudades para mejorar su calidad de vida [8 issues that cities must take care of to improve their quality of life] [Internet]. 2017. Available from: https://blogs.iadb.org/ciudades-sostenibles/es/8-temas-que-deben-cuidar-las-ciudades-para-mejorar-su-vidalidad/

2. LibeLun N. Las ciudades como catalizadoras del desarrollo económico y social a escala masiva [Cities as catalysts for economic and social development on a massive scale] [Internet]. 2019. Available from: https://blogs.iadb.org/ciudades-sostenibles/es/urbanizacion-ciudades-desarrollo-economico-social/


14. Soria JM. Informe destinos turísticos inteligentes: construyendo el futuro [Smart tourist destinations report: building the future] [Internet]. 2015. Available from: http://www.thinktur.org/media/libro-blanco-
destinos-turisticos-inteligentes- construyendo-el-futuro.pdf.
